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System features subject to change without notice.

160 CPS Matrix Printer

9621/9622

1.0

GENERAL DESCRIPTION

The Datapoint ® 160 CPS Printer is a microprocessor-controlled, tractor-fed, 9-wire dot matrix, single-density, 132-column, bidirectional printer which interfaces to Datapoint systems. The printer is available in two different models.

Model 9622, the parallel version of the printer, interfaces to any Datapoint processor with a 5500/6600 or 2200/1100 I/O bus.

Model 9621, the serial version of the printer, connects to any Datapoint terminal or processor that conforms to RS-232-C signal levels.

The printer contains a Standard Character Set located in a Read Only Memory (ROM). Each character in the ROM is designed within a 9x9 matrix. (The single-density font uses seven rows and five columns. The seven rows can be either the upper or lower seven of the nine possible rows. The five columns are not adjacent, but have a blank column between two printable ones.) This character set is a single-density font (60 dots per inch resolution) with 96 addressable and 94 printable characters. The DEL and Blank characters are nonprintable. Characters are addressed by an ASCII code between octal 040 and 177. See subsection 3.2.1 for character definition.

Forms control is processed by an electronic Vertical Format Unit (VFU) that the operator can select by setting two switches inside the printer. The two switches permit selection of forms that can accommodate from 1 to 99 lines. A separate switch permits the operator to select line spacing of 6 or 8 lines per inch (LPI). A paper-out switch is located within 1-1/2 inches of the form edge when the left-hand tractor has been moved to the leftmost position.

An operator control panel with three switches and two indicators is provided. Included in the function of the switches is an extensive self-test capable of reporting internal status, testing complex carriage motions, and printing various self-contained print patterns.

The following printer options are available:

Primary Power—When shipped, the printer is configured for 120 VAC, 50 or 60 Hz. However, during installation, it can be reconfigured for operation with input voltages of

100, 120, 220, or 240 VAC.

Address—The normal address of the printer as shipped from Datapoint is 0303. However, during installation, it can be strapped to any legal peripheral address.

Baud Rates—The 9621 serial printer is shipped from Datapoint configured to operate at 9600 baud. However, it can be reconfigured during installation for operation at 9600, 4800, 2400, 1200, 600, 300, or 150 baud. It can also be configured to operate from an external 8x or 16x clock.

Parity—The 9622 parallel printer can be configured at installation to accept data in either the 6600/5500 or 2200/1100 I/O modes. The printer is shipped configured for 6600/5500 operation.

Optional PROM Character Set—To accommodate the various character sets in the international market, provisions have been made within the printer to add a PROM (Programmable Read Only Memory).

Mechanical VFU—This factory-installable option employs a mechanical VFU chain which lets the operator adjust for printing on form lengths of from 1 through 24 inches (2.54 through 61 cm) in 1/4-inch (6.3-mm) steps.

Compressed/Expanded Print Option—This option provides additional commands to the standard printer and incorporates a Random Access Memory (RAM) Character Set Memory. With this option (via a user-generated program), the customer can:

- Modify a selected character or down-line load a custom character set on a character-by-character basis in the Compressed/Expanded Option RAM Character Set Memory.
- Expand or compress either the character set located in ROM (Standard Character Set), Optional PROM (if installed), or the Compressed/Expanded Option RAM. This allows the user to select from a variety of character pitches (1.25, 2.5, 5.0, 8.25, 10.0, or 16.5 characters per inch; and 0.75, 1.0, 1.5, 2.0, 3.0, 4.0, 6.0, or 8.0 lines per inch) via customer-generated programs. When using 16.5 CPI, 216 columns can be printed instead of 132.
- Select one of three possible character sets for printing:
 - Standard Character Set in ROM
 - Optional PROM Character Set (if installed)
 - Compressed/Expanded Option RAM Character Set
- Execute an additional down-line load forms length command.
- Set both horizontal and vertical tabs.
- Execute additional horizontal and vertical tab commands.

Stand—An optional stand (9603) is also available as an alternative to tabletop installation.

The 160 CPS Matrix Printer is designed to be used as a systems printer in data processing applications with a moderate volume of printing. Use of the 160 CPS Printer for high-volume printing requirements or high duty cycles is not recommended and will adversely affect reliability.

2.0

SYSTEM REQUIREMENTS

Both versions of the printer are compatible with all Datapoint software used to drive a local printer.

Model 9622, the parallel version of the printer, interfaces to any Datapoint processor with a 5500/6600 or 2200/1100 I/O bus.

Model 9621, the serial version of the printer, connects to any Datapoint terminal or processor that conforms to RS-232-C signal levels.

3.0

HARDWARE SPECIFICATIONS

3.1

Performance Specifications

3.1.1

Standard Printer

The following specifications apply to the standard printer without options:

Line width	132 columns, maximum
Character spacing	0.1 inch (0.254 cm)
Registration accuracy	13.2 inches +/- 0.05 inch in 132 characters
Character rate	160 characters per second, maximum
Printer throughput	60 to 500 lines per minute, nominal (see Figure 3-2)
Space slew rate	160 to 250 spaces per second, nominal
Line spacing	6 or 8 lines per inch, operator selected
Single line slew time	100 ms for 6 LPI advance and 80 ms for 8 LPI advance, maximum
Multiple line slew time	2.2 inches (5.6 cm) per second (using heaviest specified paper), minimum at 6 LPI, any multiple of 1/6 inch (0.43 cm) from 1/6 to 16-2/3 inches (0.43 to 43 cm)
Form Length (Microprocessor Control)	at 8 LPI, any multiple of 1/8 inch (0.33 cm) from 1/8 to 12-1/2 inches (0.35 to 32.5 cm)
Paper feed	front feed or bottom feed
Paper type	fan-fold, sprocket fed
Paper width	1.5 to 15 inches (3.85 to 38.5 cm)
Paper weight	15 to 20 lb (6.8 to 9.2 kg), single part
Ribbon	cartridge, Model Code 80430
Multiple part forms	maximum 6 parts (1 original plus 5 copies) original, 12 to 15 lb (5.5 to 6.8 kg)

Self-test features	copies, 9 to 12 lb (4.2 to 5.5 kg) last copy, 15 lb (6.8 kg) carbon papers, 7.25 lb (3.3 kg) with medium hardness internal diagnostics and slew pattern printing test
Environmental Storage:	-40 to 185 degrees Fahrenheit (-40 to 85 degrees Celsius)
Operating:	0 to 95% RH, noncondensing 50 to 100 degrees Fahrenheit (10 to 38 degrees Celsius)
Power Dissipation:	20 to 90% RH, noncondensing 164 BTU/hr
Input Power:	1.5 A at 120 VAC

3.1.2

Printer Operating In Compressed/Expanded Print Mode

If the printer has the Compressed/Expanded Print Option installed and the customer has elected to print in this mode, the printer performance parameters will not be the same as the specifications outlined in subsection 3.1.1 for the standard printer. Some of these variances are briefly described as follows:

Line Width—If a character pitch other than 10 CPI is specified, the line width is not 132 columns. For example, for the 16.5-CPI character pitch, the maximum line width is 216 columns.

Character Spacing—For character pitches other than 10 CPI, the character spacing is not 0.1 inch (0.254 cm). For example, for 5-CPI character pitch, the character spacing is 0.2 inch (0.508 cm).

Character Rate—The 160 characters-per-second print rate will be less using the Compressed/Expanded Print Option. Refer to Section 3.3 for details.

Parameters such as paper feed, paper type, paper width, paper weight, ribbon, multipart forms, and self-test features remain unchanged when the Compressed/Expanded Print Option is installed.

3.1.3

Printer Operating with Mechanical VFU Option

If the printer has the mechanical VFU option installed and the customer has elected to operate with a format chain, the Forms Length specification for this mode of operation is as follows:

Forms Length (Format Chain Control)	from 1 to 24 inches (2.54 to 61 cm) 6 LPI: any multiple of 1/2 inch (1.3 cm) 8 LPI: any multiple of 1/4 inch (0.6 cm)
--	--

If the printer has the mechanical VFU option installed, the customer can select the Form Length to operate under microprocessor control (see Section 3.6).

3.2

Character Sets

3.2.1

Standard Character Set

The Standard Character Set shipped with every printer is defined in Figure 3-1. This character set is located in a ROM and cannot be altered under program control. The characters are basically designed using the top or bottom seven rows of a 9x9 dot matrix.

Each character to be printed is assigned an ASCII code from octal 040 through 177. There are 96 addressable and 94 printable characters. Octal code 040 (ASCII blank) is treated as a "space" character. Octal code 177 (ASCII DEL) is ignored.

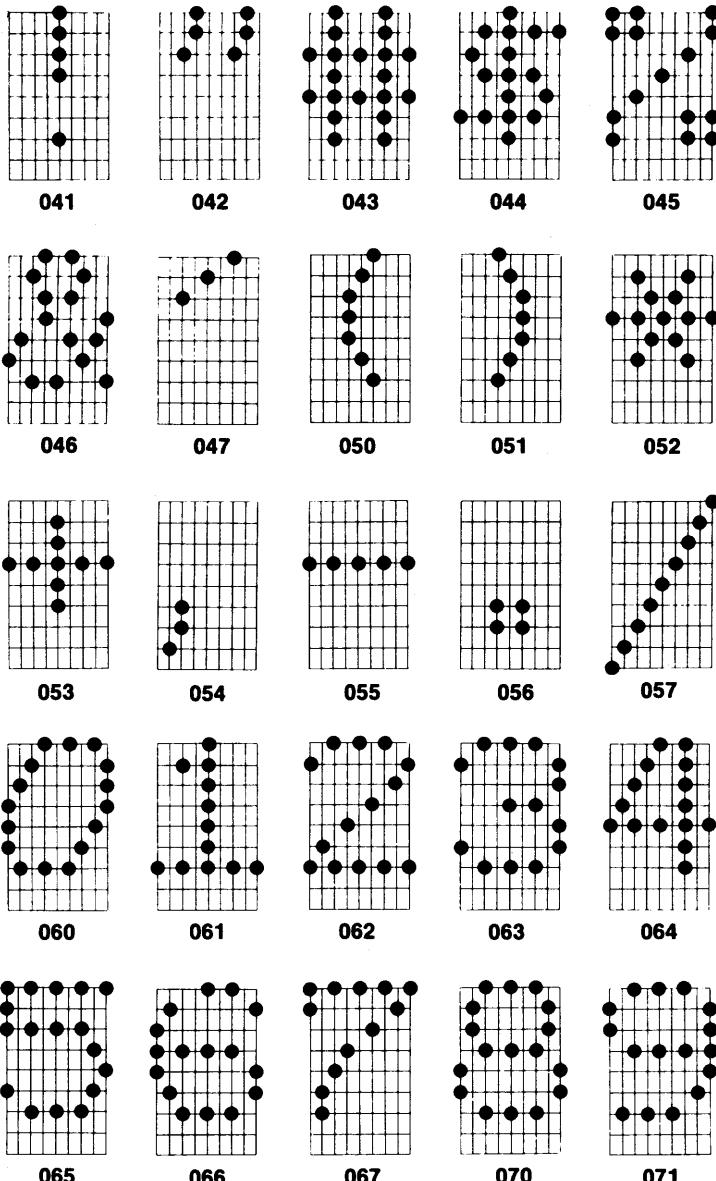


Figure 3-1. Character Set Font

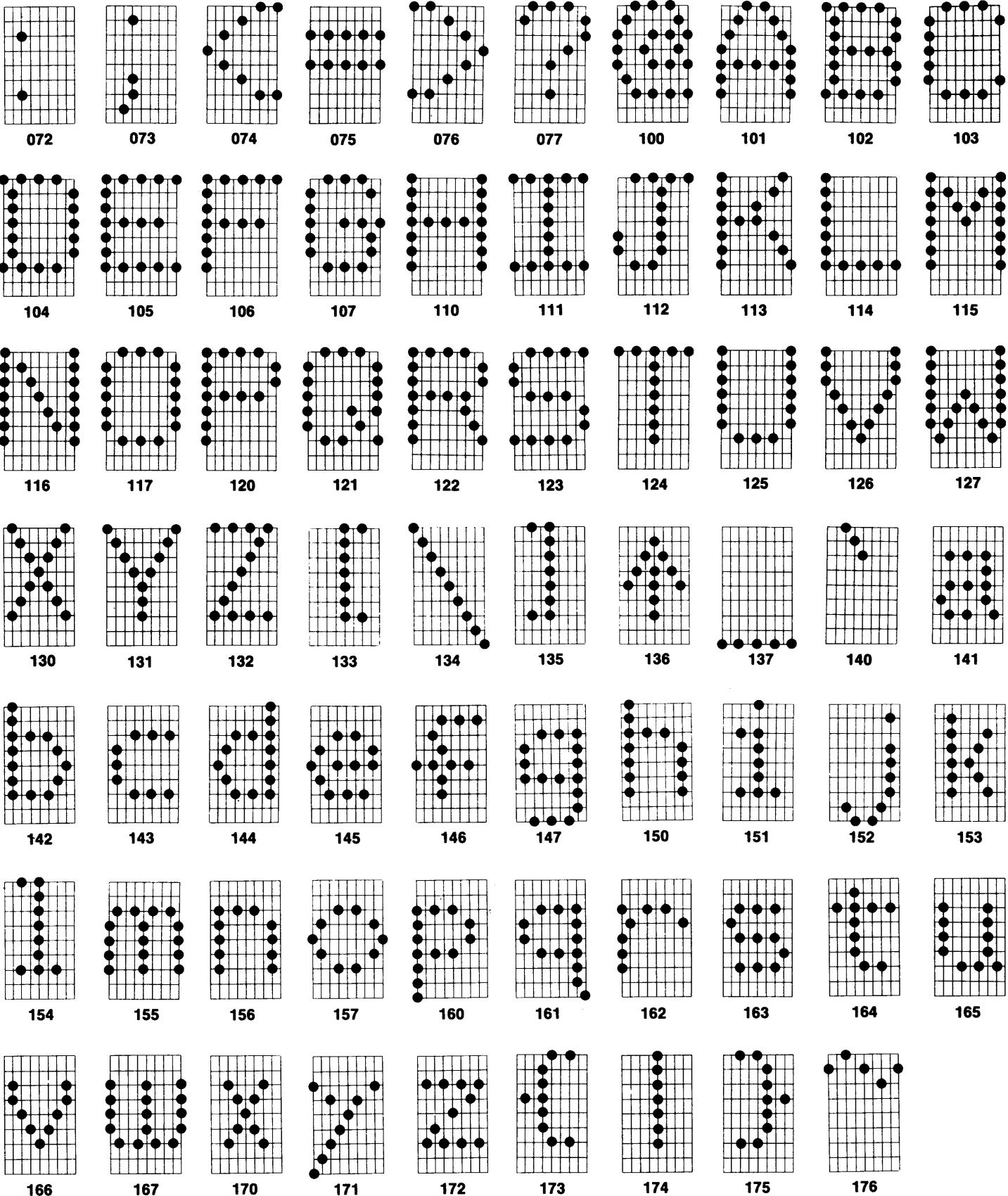


Figure 3-1. Character Set Font (continued)

If the Optional PROM is not installed in the printer, this character set will automatically be selected and its contents loaded into the Compressed/Expanded Font Option RAM Character Set Memory (if installed) by the printer at power-up or system initialization.

3.2.2

Optional PROM

Because of the variance in character sets within the international markets, Datapoint has provided manufacturing the capability, through some distribution centers, to create a PROM with a custom-designed character set. Refer to the Datapoint Character Set Generator for 9621 and 9622 Matrix Printers CHARFP2 User's Guide (Document Number 50475) for details on how to create a PROM with custom fonts.

The contents of the Optional PROM cannot be altered by the customer under program control.

When the Optional PROM is installed in the printer, this character set will automatically be selected and its contents loaded into the Compressed/Expanded Font Option RAM Character Set Memory (if installed) by the printer at power-up or during system initialization.

3.2.3

Compressed/Expanded Print Option Character Set

When this option is installed in the printer, the customer has the following additional character set capability:

Generate a Custom Character Set

This option adds a Random Access Memory (RAM). The RAM is automatically loaded with a character set from either the Optional PROM or the ROM at power-up or during system initialization. (See subsections 3.2.1 and 3.2.2.)

After power-up or system initialization, the customer can modify the character set on a character-by-character basis via a customer-generated program.

Horizontal (characters per inch)

				Double Wide	Quad Wide	Octal Wide
	16.5	10	8.25	5	2.5	1.25
V	x	x	x	x	x	x
e	x	x	x	x	x	x
r	Double High	-	x	x	x	x
t	4	-	x	x	x	x
c	3	-	x	x	x	x
a	Quad High	-	x	x	x	x
i	2	-	x	x	x	x
	1.5	-	x	x	x	x
L	Octal High	-	x	x	x	x
P	1.0	-	x	x	x	x
I	0.75	-	x	x	x	x

x = possible allowed combination

- = not allowed (16.5 compressed print can only be used with 6 or 8 lines per inch).

Table 3-1. Possible Print Combinations with Compressed/Expanded Print Option

The custom character set will be cleared whenever power-up or system initialization occurs.

Select Character Sets

The customer can select from three character sets for printing:

- Standard Character Set in ROM
- Optional PROM Character Set (if installed)
- Compressed/Expanded Optional RAM Character Set

Compress or Expand a Selected Font

The customer can select the character set from the ROM, the Optional PROM, or the Compressed/Expanded Option RAM, and compress or expand the characters in the selected character set. Tables 3-1 and 3-2 define the possible printable combinations and the width/height of the resulting characters.

Font Size		Character Width (inches)	Character Height (inches)
Octal High	1.0 LPI 0.75 LPI		0.967 1.212
Octal Wide	1.25 CPI	0.606	
Quad High	2.0 LPI 1.5 LPI		0.482 0.606
Quad Wide	2.5 CPI	0.303	
Double High	4.0 LPI 3.0 LPI		0.241 0.303
Double Wide	5.0 CPI	0.151	
Single High	8.0 LPI 6.0 LPI		0.120 0.151
Single Wide	8.25 CPI 10.0 CPI 16.5 CPI	0.098 0.081 0.048	

Note: Only 16.5 CPI is limited to single height; other widths may assume any height.

Table 3-2. Normal Character Matrix Sizes In Compressed/Expanded Print Option

3.3

Print Rate

3.3.1

Print Rate Single-density Character Sets (60 dots/inch resolution)

Single density is the printer's normal default mode. When selected, the carriage on the 160 CPS Matrix Printer moves at a constant velocity of 16 inches per second across the entire print line, controlled by a servo system. Character spacing is 10 characters per inch, which yields the 160 characters-per-second print rate.

Figure 3-2 graphs lines per minute (LPM) printed against the number of nonblank characters per line. The greatest line print rate is achieved when all the nonblank characters on successive lines form a single column down the page; the lowest line print rate occurs when the nonblank characters on successive lines are printed across the entire 132 columns of the line.

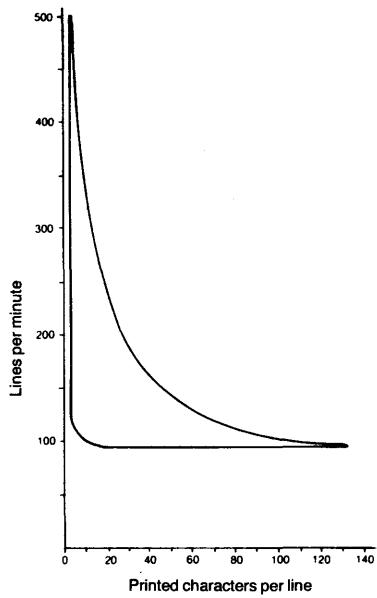


Figure 3-2. Print Rate (LPM) 10 CPI

3.3.2

Print Rate Double-density Character Sets (120 dots/inch resolution)

The Double-density mode instructs that any character is required to print a dot in adjacent columns of a given row. In the following example, when printing a single-density "+" character, Row 4 has a missing dot for columns 2, 4, 6, and 8. For a double-density character, the character design places a dot in these columns. See the following examples:

Row	Column								
	1	2	3	4	5	6	7	8	9
1									
2				X					
3				X					
4	X		X		X			X	
5				X					
6				X					
7									
8									
9									

"+" Character Double Density

If the customer has designed a double-density character set and wishes to print it, the double-density command must be invoked via a customer-generated program. (See subsection 3.9.2.) When the double-density command is invoked, the print rate is half the single-density print rate.

3.3.3

High Dot Density Character Set

If the Compressed/Expanded Print Option is installed and the Compressed/Expanded Font RAM character set is selected, the print rate is determined by an algorithm within the microprocessor. A delay will be invoked if: (1) more than 21 dots comprise any character within the Compressed/Expanded Font RAM, or (2) the total number of dots in the Compressed/Expanded Font RAM exceeds the number of dots in the Standard ROM Character Set. A delay of up to 3.5 seconds may be experienced following a printed line, depending upon the character set dot density.

3.4

Operator Controls and Indicators

3.4.1

Power ON/OFF Switch

The primary power ON/OFF switch is located on the lower right rear of the printer. When power is ON, the POWER indicator is illuminated.

3.4.2

Front Panel Indicators and Switches

Front panel indicators and switches are located on the right front of the printer (see Figure 3-3). These controls and their functions are listed below:

Name	Function
POWER	The POWER indicator lights when power is applied.

FAULT	The FAULT indicator flashes when one of the following conditions exists: Paper out; Cover open.
--------------	---

Row	Column								
	1	2	3	4	5	6	7	8	9
1									
2				X					
3				X					
4	X		X		X			X	
5				X					
6				X					
7									
8									
9									

"+" Character Single Density

	<p>The FAULT indicator glows steadily under the following conditions:</p> <ul style="list-style-type: none"> Carriage jam; Machine fault.
RESET	<p>When pressed, the RESET switch:</p> <ul style="list-style-type: none"> Initiates a Power-on-reset if a machine fault exists (FAULT indicator lighted). Clears a paper-out fault for one line. <p>With the cover closed:</p> <ul style="list-style-type: none"> Pressing RESET, then LINE, without releasing RESET, starts a slew pattern test—holding RESET and LINE repeats the test. Pressing RESET, then FORM, without releasing RESET, invokes internal diagnostic tests. <p>With the cover open:</p> <ul style="list-style-type: none"> Pressing RESET, then LINE, without releasing RESET, advances the paper 1/96 inch. Pressing RESET, then FORM, without releasing RESET, resets electronic top-of-form to the present location, and resets electronic form length to the value indicated by the Form Length Switches.
FORM	When pressed, the FORM switch advances paper to the next top-of-form, overriding the paper-out sensor.
LINE	When pressed, the LINE switch advances paper one full line, overriding the paper-out sensor.

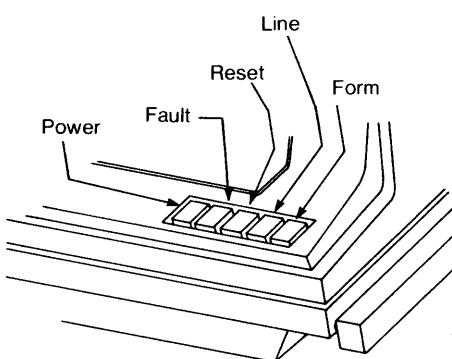


Figure 3-3. Controls

3.5

Paper Feeding

Before paper can be fed into the printer, raise the top (by lifting at the sides near the front) and open the carriage (by pushing back the Platen Retract Lever on the left side of the chassis).

Use the slot in the front of the printer for tabletop paper loading; when the printer is mounted on its optional stand, use either front feed or bottom feed (see Figure 3-4).

Feed paper from under the front of the machine through one of the two slots in the baseplate. Clamp the paper into the tractor and run it out over the back to be stacked on the

floor behind the printer. Finally, close the carriage by moving the Platen Retract Lever on the left side of the chassis from its temporary pushed-back position to fully forward.

Next, adjust for paper thickness by appropriately positioning the Forms Thickness Adjustment Lever on the right-hand side of the chassis to the click stop corresponding to the paper thickness. For multipart forms, the best last copy is obtained when the Forms Thickness Adjustment Lever is as far upward as possible while still maintaining acceptable print on the first copy.

When the LINE switch is pressed, one standard line spacing (based on the setting of the 6/8 LPI switch on the tractor) is performed. When the FORM switch is pressed, paper is fed, under microprocessor control, to the next logical top-of-form. If the optional form length chain is used, paper is fed until the form flag is sensed and passed by one line. After performing this manual form feed and before starting printing, ensure correct paper registration.

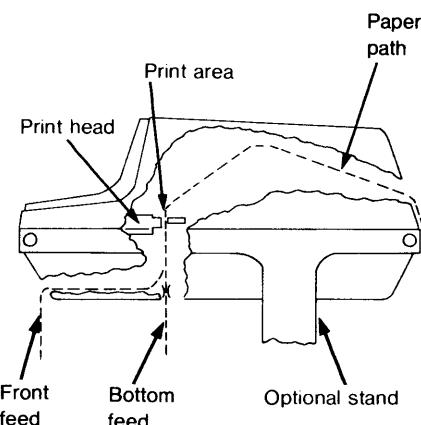


Figure 3-4. Paper Feeding

3.6

Tractor Controls

3.6.1

Vertical Forms Alignment—Microprocessor Control

Form length is set by the two switches located on the rear left of the controller board inside the printer. Dial the number of lines in the form. For example, an 11-inch form at 6 lines per inch contains 66 lines. To make the printer handle this length, set the switch dials to 66. To enable microprocessor control of the tractor, these switches must be set to a value other than 00.

Line spacing is set by the toggle switch located next to the two Form Length Select switches on the controller board inside the printer. The operator must select either 6 or 8 lines per inch (LPI) spacing.

After the Form Length Select and Line Spacing switches have been set, the tractor drive system is aligned by activating the FORM switch on the front panel.

To establish the top-of-form position on the form, rotate the manual Paper Drive Control knob on the left end of the tractor in either direction. This aligns the form to the desired top-of-form position.

If you reverse the Paper Drive Control knob to push the paper back into the machine, be sure to apply tension to the paper from below to prevent jamming.

After the paper is correctly positioned, without advancing the paper, press RESET and FORM with the cover open to reset the printer to the desired form length.

3.6.2

Vertical Forms Alignment—Mechanical VFU Control

To enable the mechanical VFU control, the two Form Length Select switches on the rear left of the controller board inside the printer must be set to 00.

Line spacing is set by the toggle switch located next to the Form Length Select switches on the controller board inside the printer. The operator must select either 6 or 8 lines per inch (LPI) spacing.

The vertical forms length chain is located on the right end of the tractor. The operator can adjust this VFU chain to format the printer for any paper length from 1 to 24 inches (2.54 to 61 cm).

The VFU chain is adjusted by removing or inserting links. Each link in the format chain corresponds to 0.25 inch (0.63 cm) of vertical paper motion. Therefore, for a standard 11-inch (27.9-cm) form, 44 links are required. At least one flag link in each chain must denote the top-of-form position.

For 6 LPI spacing, every two lines in the format chain correspond to 0.5 inch (1.3 cm), or three lines of vertical paper motion. Therefore, when operating at 6 LPI, the chain can halt at every other link. Thus, for correct 6 LPI operation, the total number of links in the chain (including flags) must be an even number.

At 8 LPI spacing, every link corresponds to 0.25 inch (0.63 cm), or two lines of vertical paper motion. Therefore, when operating at 8 LPI, the chain can halt at any link.

Since the chain will not fit on the tractor if it is shorter than 18 links (including flags), forms shorter than 4.5 inches (11.43 cm) require multiple flags. For example, 4-inch (10.16-cm) forms require 15 links and a flag, then another 15 links and a flag.

After the optional forms length chain and the Form Length Select and Line Spacing switches have been set, the tractor drive system is aligned by activating the FORM switch on the front panel.

To establish the top-of-form position on the form, disengage the clutch on the right-hand side of the tractor. With the clutch disengaged, rotate the manual Paper Drive Control knob on the left end of the tractor in either direction. This aligns the form to the desired top-of-form position. If you reverse the Paper Drive Control knob to push the paper back into the machine, be sure to apply tension to the paper from below to prevent jamming.

Press the FORM switch; the printer will feed paper until it reaches the next top-of-form. Assure correct registration before beginning printing.

3.7

Programming Considerations

The printer is designed to accept two types of command formats:

Nonformatted Command String—Command strings are generally single commands in octal format.

Formatted Command String—Command strings are identified by command names, followed by the ANSI abbreviation, followed by the character sequence within parentheses. A comma separates characters. The #i value indicates the i-th parameter, which consists of an unspecified number of ASCII characters representing the digits 0 through 9. The value of #i is the value of the digits taken as a decimal integer, with the most significant digit received first. A semicolon (073) separates parameters.

Three formats are available:

- 033 followed by a single character in the range 040 through 0176 (not 0120 or 0133).
- 033 0120 followed by a character in the range 040 through 0175 or a string of characters in the range 040 through 0176, including 033 and 0140. The character following the P (0120) is used to expand this format for future use with 0176 reserved to expand to an additional character.
- 033 0133 # 1 073 # 2-73...#i l1 l2...In F. The #i value is in the range 060 through 077. The l value is in the range 040 through 057. The F value is in the range 0100 through 0176. The meaning of "F" is modified if an "I" is present. A zero or missing i returns the printer to the default on that parameter.

When the printer receives an illegal command, it will ignore the command and start printing the ASCII equivalent characters for the rest of the command following the violation.

Because the printer can execute additional commands when the Compressed/Expanded Font Option is installed, the following command definitions are divided into two sections.

3.8

Standard Printer Commands

The printer always recognizes the following standard printer commands.

3.8.1

Carriage Return

015 (Octal)

The Carriage Return command moves the print position to column 0, the column adjacent to the left limit of carriage motion.

3.8.2

Tab to Column

001,msd,lsd (Octal)

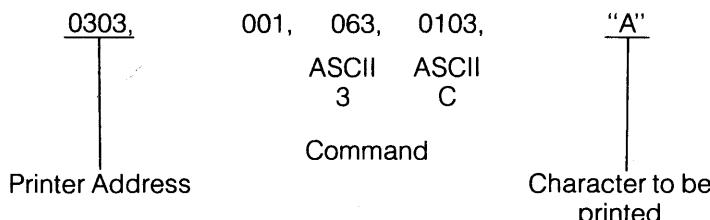
The Tab to Column command moves the print position to the column specified by msd and lsd. Column position may be any value 00 through 083 hexadecimal (0 through 131 decimal). The msd and lsd values are two ASCII character hexadecimal digits that specify the column position rela-

tive to column 0. The most significant digit is msd. Column width is determined by the currently selected column width.

To down-line load a Tab to Column command on the 160 CPS Printer, convert the decimal column number to hexadecimal.

For example, to instruct the printer to tab to column 60 and print the character "A" at this column:

1. Convert 60 to hexadecimal. $60 = 3C$ (hex).
2. The command is coded as follows:



3.8.3

Line Feed

012 (Octal)

The Line Feed command advances the tractor one line. Line spacing is a function of the currently selected number of print lines per inch, controlled by the 6/8 lines-per-inch switch or as commanded by the software.

3.8.4

Microline Feed

016 (Octal)

The Microline Feed command causes the tractor to advance paper 1/24 inch.

3.8.5

Form Feed

014 (Octal)

The Form Feed command causes the tractor to advance paper to the next top-of-form.

3.8.6

Down-line Load Forms Length

033,014,n2,n1

The Down-line Load Forms Length command inhibits internal forms control and substitutes the form length specified in n2, n1 as the desired form length.

Note: The n2 and n1 values are two 6-bit binary numbers which define the form length in 1/96-inch increments. The two numbers are defined as follows:

n2
x x b5 b4 b3 b2 b1 b0
n1
x x b5 b4 b3 b2 b1 b0

The two high-order bits in each byte are ignored. The low-order bits are linked together to give the form length in 1/96-inch increments (n2 is the most significant byte). The n2 and n1 values may be sent as printable characters, provided octal 0177 is not sent. Octal 0177 (DEL) is discarded by the input routine.

To down-line load the forms length:

1. Multiply the length of the form in inches by 96.
2. Compute the binary equivalent of the total.
3. Split the binary word into two 6-bit words.

For example, to down-line load for a 10.5-inch form:

1. Multiply 10.5 by 96 = 1008.
2. Convert 1008 to its binary equivalent: 001 111 110 000.
3. Split the binary word into two 6-bit words: 001111 (octal 017) and 110000 (octal 060).
4. The command to establish a 10.5-inch form is: 033,014,017,060.

3.8.7

Forms Length Reset

023 (Octal)

The Forms Length Reset command resets the printer to utilize internal switches for forms length.

3.9

Compressed/Expanded Font Option Commands

The following additional commands can be executed by the printer when the Compressed/Expanded Character Set Option is installed.

3.9.1

Select a Character Set

033,0133,#a,0155

The Select a Character Set command selects one of three character sets that may be present in the printer, based on #a determination:

#a	Character Set
10	Optional PROM*
11	Standard ROM
12	Optional PROM
13	Compressed/Expanded RAM

*If the Optional PROM Character Set is not installed, the Standard ROM Character Set is selected.

Any values of #a except those listed will result in no change in the previously selected font.

For example, to select the Compressed/Expanded Option RAM Character Set, the following command is used:

033,0133,"13",0155

If the program attempts to select a character set that is not installed, the printer will select the Optional PROM Character Set, if installed. If the Optional PROM set is not installed, the printer will select the Standard ROM Character Set.

3.9.2

Select Character Set Density

033,0120,041,040,#d,033,0134

The Select Character Set Density command informs the printer of the density of the character set. If #d is "1," the character set is a normal or single-density character set (60 dots per inch); if #d is "2," the character set is a double-density character set (120 dots per inch).

For example, to inform the printer a dual-density character set is to be used, the following command is entered:

033,0120,041,040,"2",033,0134

The printer does not automatically select the character set density. If a double-density character set is to be printed, the customer program must inform the printer a double-density character set is selected. Otherwise, the printout will not be legible.

3.9.3

Compress/Expand Selected Font

033,0133,"#v;#h",040,0107

See Table 3-1 for valid combinations of #v and #h.

Specification in the #v (vertical line spacing) is defined as the height of the line in 1/1440 inches on the tractor, and #h, the width of the character in 1/1440 inches. The 160 CPS Matrix Printer allows only certain decimal values of #v and #h, and ignores all others. Also, certain assumptions about character height are made for the #v values. Valid values for #v are as follows:

180/1440 inch—8 LPI (assumes single-height characters)
240/1440 inch—6 LPI (assumes single-height characters)
360/1440 inch—4 LPI (assumes double-height characters)
480/1440 inch—3 LPI (assumes double-height characters)
720/1440 inch—2 LPI (assumes quadruple-height characters)
960/1440 inch—1.5 LPI (assumes quadruple-height characters)
1440/1440 inch—1 LPI (assumes octal-height characters)
1920/1440 inch—0.75 LPI (assumes octal-height characters)

Valid values of #h are as follows:

87/1440 inch—16.5 CPI
144/1440 inch—10.0 CPI (default value)
174/1440 inch—8.25 CPI
288/1440 inch—5.00 CPI (printer assumes double-dot density)
576/1440 inch—2.50 CPI (printer assumes quadruple-dot density)
1152/1440 inch—1.25 CPI (printer assumes eight times [octal] dot density)

For example, to set the printer for 8 LPI line spacing and 16.5 CPI character spacing, the following command is used:

033,0133,"180;87",040,0107

3.9.4

Load a Character

033,0120,041,CHAR,#1;...#9,033,0134

The Load a Character command allows modification of the dot matrix for any character in the Compressed/Expanded Option RAM Character Set. Matrix modification is accomplished one character at a time. A customer-generated

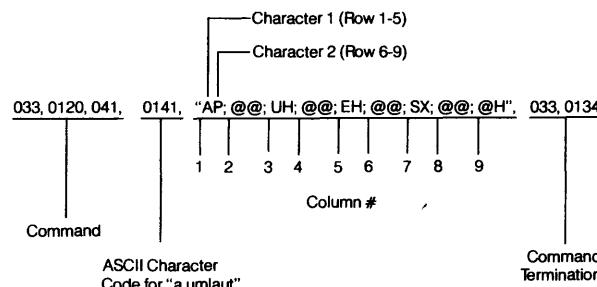
program to transmit 94 separate commands is required to modify all 94 printable characters.

The ASCII character CHAR must be in the range 041 to 176.

To create a new character to be used by the 160 CPS Printer, a 9x9 dot matrix is used. (Columns are left to right; rows, top to bottom.) Only seven of the nine rows can be utilized in any single column, the top seven or the bottom seven. If the character is to be single density, alternate columns are all zeros.

The #1 through #9 values represent the dot pattern to be specified for columns 1 through 9. A column is specified by two ASCII characters. To select these codes, the first character represents rows 1 through 5; the second character, rows 6 through 9. Table 3-3 shows the ASCII code for the various dot patterns.

For example, to modify the domestic character single-density "a" to the foreign single-density character "a umlaut," the command shown in Figure 3-5 is specified.



Note: After the character set has been modified, the customer program must select the Compressed/Expanded RAM Character Set to print the modified characters. See subsection 3.9.1 for correct command format.

COL	
	1 3 5 7 9
1	0 1 0 1 0
2	0 0 0 0 0
3	0 1 1 0 0
4	0 0 0 1 0
5	1 1 1 1 0
6	1 0 0 1 0
7	0 1 1 1 1
8	0 0 0 0 0
9	0 0 0 0 0

Columns 2, 4, 6, 8 are all 0 for single-density character.

Figure 3-5. "a umlaut" Single-density Character Layout

Using the Load Character Command

DOT PATTERN										
Row					Row					ASCII Equivalent
1	2	3	4	5	6	7	8	9	Code	
0	0	0	0	0	0	0	0	0	@	
0	0	0	0	1	0	0	0	0	A	
0	0	0	1	0	0	0	0	1	B	
0	0	0	1	1	0	0	0	1	C	
0	0	1	0	0	0	0	1	0	D	
0	0	1	0	1	0	0	1	1	E	
0	0	1	1	0	0	0	1	1	F	
0	0	1	1	1	0	0	1	1	G	
0	1	0	0	0	0	1	0	0	H	
0	1	0	0	1	0	0	1	0	I	
0	1	0	1	0	0	1	0	1	J	
0	1	0	1	1	0	0	1	1	K	
0	1	1	0	0	0	1	1	0	L	
0	1	1	0	1	0	0	1	1	M	
0	1	1	1	0	0	1	1	1	N	
0	1	1	1	1	1	0	1	1	O	
1	0	0	0	0	1	0	0	0	P	
1	0	0	0	1	0	0	0	1	Q	
1	0	0	1	0	1	0	0	1	R	
1	0	0	1	1	0	0	1	0	S	
1	0	1	0	0	1	0	1	0	T	
1	0	1	0	1	0	1	0	1	U	
1	0	1	1	0	1	0	1	1	V	
1	0	1	1	1	0	0	1	1	W	
1	1	0	0	0	1	1	0	0	X	
1	1	0	0	1	1	1	0	1	Y	
1	1	0	1	0	0	1	1	0	Z	
1	1	0	1	1	0	1	1	1	[
1	1	1	1	1	0	1	1	1]	
1	1	1	1	1	1	1	1	1	Underline	

Table 3-3. ASCII Code for Dot Pattern

3.9.5

Horizontal Tab Set

033,0120,042, "#1;...#i",033,0134

The Horizontal Tab Set command sets horizontal tab stops at each column number, #i. The column number is one space width at whatever pitch is active.

For example,

033,0120,042, "1;40",033,0134

sets a horizontal tab stop at column 40; and

033,0120,042, "2;80",033,0134

sets a second horizontal tab stop at column 80. The printer now has two horizontal tab stops programmed at columns 40 and 80.

3.9.6

Horizontal Tab PRIVATE USE

033,0133,#h,0160

The Horizontal Tab PRIVATE USE command moves the carriage to print at the next tab stop. The tab stops must be established by the Horizontal Tab Set command of subsection 3.9.5.

The Horizontal Tab PRIVATE USE command must be followed by a print command to invoke carriage motion.

If #h is 0, 1, or absent, the printer will be set to tab to the next tab stop. For example,

033,0133,"0",0160

will instruct the printer to move the carriage to the next tab stop. If the stops had been set according to the example in subsection 3.9.5 at columns 40 and 80, this command would:

- Condition the printer to move to column 40 on the next print command if the carriage is at a column less than 40.
- Condition the printer to move to column 80 on the next print command if the carriage is at a column position greater than 40 but less than 80.
- Condition the printer to move to the end of the line on the next print command if the carriage is at a column greater than 80.

A 033,0133,"2",0160 command conditions the printer to move the carriage to the following position on the next print command.

If the carriage is at a column position less than 40, the carriage moves to column 80. If the carriage is at a column position greater than 40, the carriage moves to the end of the line.

Note: PRIVATE USE signifies that the command format is defined by ANSI, but no standard meaning has been assigned by ANSI.

3.9.7

Vertical Tab Set

033,0120,043, "#1;...#i",033,0134

The Vertical Tab Set command sets vertical tab stops at each line number, #i. Line spacing is configured by the 6/8 LPI switch or by program control.

For example,

033,0120,043, "1;10",033,0134

sets a vertical tab stop 10 line spaces down the form; and

033,0120,043, "2;20",033,0134

sets a second vertical tab stop 20 line spaces down the form.

3.9.8

Vertical Tab PRIVATE USE

033,0133,#v,0163

The Vertical Tab PRIVATE USE command vertical tabs to the next tab stop. If #v is 0, 1, or absent, the printer tabs to the next stop. If #v is greater than 1, the printer tabs across that many stops or to the next top-of-form. Paper motion occurs when all previous executable functions have been completed.

For example,

033,0133,"0",0163

moves the form to the next vertical tab stop. If the vertical tab stops have been set according to subsection 3.9.7 and the form is at a position less than 10 lines, it will slew the form to line 10. If the form is at a line greater than or equal to 10 but less than 20, the command will slew the form to line 20. If the form is at a line greater than 20, it will slew to the next top-of-form.

The command

033,0133,"2",0163

will slew the form to the second vertical tab stop. If the form is at a line position less than 10, it will slew the form to line 20. If the form is at a line greater than 10, it will slew to the next top-of-form.

3.9.9

Down-line Load Forms Length PRIVATE USE

033,0133,#p,0162

The Down-line Load Forms Length PRIVATE USE command changes the form length to #p. If #p (decimal) is omitted from the data stream, the stored value of the missing parameter is unchanged. This command is ignored if a mechanical VFU is present.

For example,

033,0133,"5.5",0162

sets a form length of 5.5 inches.

3.9.10

Default (Print Option reset) PRIVATE USE 1

033,0121

The Default (Print Option reset) PRIVATE USE 1 command sets all programmable values back to default conditions and simulates a carriage return command (the carriage is not moved). The electronic top-of-form is not changed, and no internal self-testing is performed. All previous commands in the buffer are executed prior to this command.

4.0

PHYSICAL DESCRIPTION

Figure 4-1 shows the dimensions of the printer, which weighs approximately 110 pounds (50 kg) with the optional stand. Without the stand, it weighs approximately 50 pounds (22.4 kg).

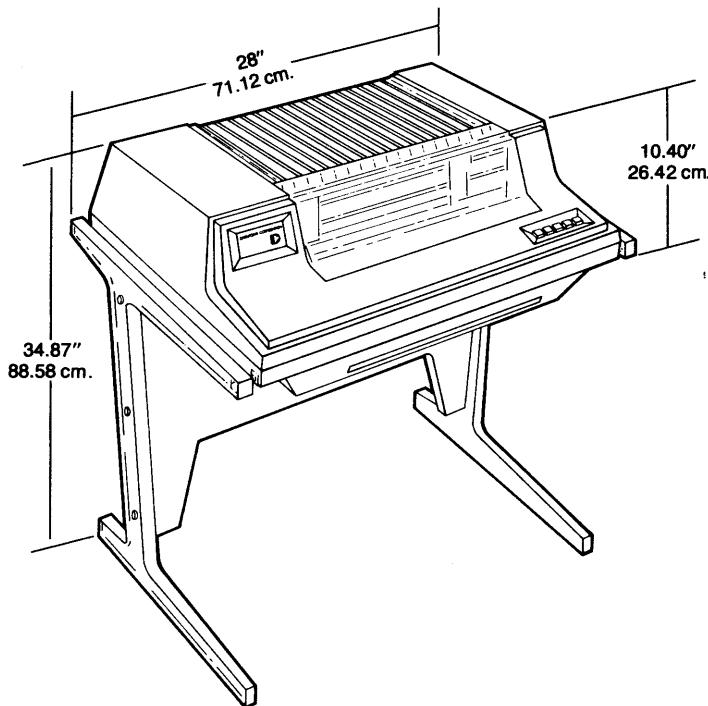


Figure 4-1. Printer Dimensions

5.0

ENVIRONMENTAL REQUIREMENTS

The printer may be operated only in a noncorrosive and noncondensing atmosphere with a relative humidity between 20 and 90 percent and a temperature between 50 to 100 degrees Fahrenheit (10 to 38 degrees Celsius). This range may be restricted by paper and ribbon environmental specifications. It is recommended that the printer be operated in an environment that would be comfortable for the person operating it.

The printer may be stored in a noncorrosive and noncondensing atmosphere with a relative humidity between 0 to 95 percent and temperature between -40 and 185 degrees Fahrenheit (-40 and 85 degrees Celsius).

Acoustical Noise Level: 75 dBA.

The acoustical noise level is recorded with a measuring instrument located at the approximate position of a seated person's ear (i.e., four feet above the floor) one meter directly in front of the printer. The printer is resting on a Datapoint printer stand (i.e., 27-inch table height).

Heat Dissipation: 164 BTU/hr.

Warning: This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instruction manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

6.0

INTERFACE REQUIREMENTS

6.1

Serial Interface

The serial interface contains the connector and electronics necessary to receive and transmit signals, conforming to the RS-232-C specification for modem control and asynchronous bit serial data. A cable kit is available to connect the printer to a Datapoint 8200 workstation. A different cable (Model Code No. 9443) is used to connect it to a Datapoint 1550.

6.1.1

Serial Interface Connector Pins

The connector pin assignments are as follows:

Pin	Signal	Direction
40-43	GROUND	Input
44	RING DETECT	Input
45	RECEIVED DATA	Input
46	8x EXTERNAL CLOCK	Input
29	TRANSMITTED DATA	Output
30	DATA TERMINAL READY	Output
31	REQUEST TO SEND	Output
32	ON LINE	Output

33	CLEAR TO SEND	Input
34	CARRIER DETECT	Input
35	DATA SET READY	Input
36	SECONDARY REQUEST TO SEND	Output
6.1.2		

Transmitting Serial Status Information

When the printer On Line bit is true and the Secondary Request To Send (SRTS) bit is true, the processor may send serial data to the printer. The printer sets the SRTS bit false when its buffer is within 64 characters of full. The processor may monitor this SRTS bit to control the transmission rate, or pad characters (0177 octal) may be embedded in printer data to keep the processor from overrunning the printer's buffer.

6.2

Parallel Interface

The parallel interface provides the connectors and electronics needed to receive data and commands from a Datapoint processor with a 5500/6600 or 2200/1100 I/O bus and to respond with status information.

6.2.1

Parallel Interface General Description

All 50 lines are connected between the I/O bus input and output connectors. Lines carrying the bus voltages handle the maximum specified currents for those lines. The I/O bus ground lines are connected to the printer logic ground by the most direct path between the I/O connectors and the controller board.

The printer uses the bus +5 volt line only to power the 3-state AIN drivers, and draws 250 mA (maximum) from the line. Since this line can vary from +4.2 to +7.5 volts, a regulator ensures limitation to +5.2 volts. When the bus +5 volt line is below +4.2 volts, the address and parity error flip-flops are held clear and the write ready flip-flop is held set. No other circuitry is affected by the absence of the bus +5 volts, allowing the printer to be used in its self-test mode with the processor either disconnected or turned off. The power-on-reset is connected so that the printer power can be cycled without disturbing the processor I/O bus, as long as the processor is not trying to use the printer.

The I/O data bus is 8 bits parallel, with bit 8 providing odd parity. The parity bit is used only in 6600, 5500, and 1800 operation. For nonparity operation, a jumper strap is provided on the printer controller board inside the cover to disable parity detection.

When the printer is to be accessed, the processor must select it by its address. If the appropriate address value is given from the processor, the printer becomes addressed and returns a status signal to the processor. The printer remains addressed until it detects that the processor is addressing another device, has received incorrect address parity, or the power-on-reset in the machine becomes active.

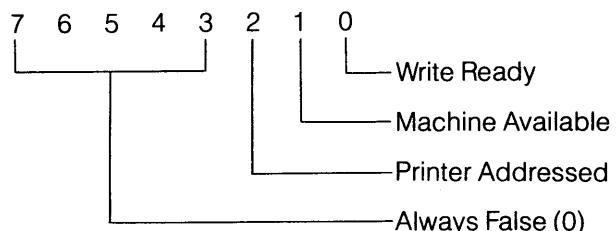
Note: If the printer is being addressed by the processor and a self-test is initiated, the printer will go off-line and transmit a parity error.

The printer parallel interface card contains a 16-pin IC socket (XJ1) to connect an address adaptor (EXP1) used

to determine the I/O bus address for the printer. The printer may be operated in a "daisy chain" configuration like other Datapoint peripheral devices.

When the printer is addressed, it returns a status byte on the processor input bus (there is no DATA mode) with the following format:

STATUS BYTE



The Printer Addressed bit goes true (low) when addressed to indicate that the printer is connected to the I/O bus, powered, and addressed. If no faults occur (carriage jam, paper out, cover open) and the printer is addressed, the Machine Available bit goes true (low). When the Machine Available bit is true and the interface is ready to accept a character or command, the Write Ready bit goes true. The Always False (zero) bits are reserved for future use.

If the Write Ready status bit is true, the desired data or control character can be placed on the processor output bus. This causes the Write Ready bit to go false until the printer processes the character, at which time the Write Ready bit can go true again.

The printer processes 556 characters in a first-in, first-out (FIFO) buffer queue. The FIFO buffer passes the data to be printed into a separate print line buffer. The FIFO buffer holds the incoming characters while the line buffer is printing. The ASCII DEL (177) character is ignored. If the processor sends line length greater than the printer can accommodate, the excess characters are ignored and not printed. For example, when printing at 10 CPI, all columns past 132 are ignored. If the printer is set up to print 16.5 CPI, all columns past 216 are ignored.

Printing occurs whenever:

- A carriage return command is received,
- The line buffer becomes full, and
- A paper feed command is received.

6.2.2

Parallel Interface—Signal Description

Data and Control Lines Description

All data, strobes, and status signals between the printer and the Datapoint processors are low true and high false TTL levels.

Receive Data (AOUT0-8)

Data are received by the printer in 8-bit parallel mode (AOUT0-7), with bit 8 providing odd parity. The parity bit is used only in 5500/6600-type I/O bus operations. AOUT0-7 are data bits or device address bits, depending upon the command strobe that accompanies them. For nonparity operation, a strap is provided on the printer controller card to disable parity detection.

Parity Error Feedback (PERR)

If the sum of the true (low) bits received on the AOUT0-8 bus is even when the leading edge (i.e., negative going) of the command strobe (EX ADR, EX WRITE) is received, the PERR line back to the processor is set true (low). Once the PERR line has been set, it remains so until another strobe is received with good parity (not used with 2200/1100 processor).

Execute Address (EX ADR)

The EX ADR command is a minimum two-microsecond true (low) strobe which, when accompanied by the proper address on AOUT0-7, selects the printer to use the I/O bus. The printer's normal address is octal 0303, but it may be optionally strapped to any legal peripheral address. Once addressed, the printer will remain addressed until one of the following occurs:

- A power sequence in either the printer or the processor is executed, or
- Another EX ADR strobe with a different address or incorrect parity on AOUT0-7 is detected.

Execute Write (EX WRITE)

The EX WRITE command is a minimum two-microsecond true (low) strobe. The EX WRITE strobe is recognized by the printer only when it is addressed and parity is good. EX WRITE gates the data on the AOUT bus into the printer electronics.

Input (INPUT)

The INPUT command on the I/O bus is generated and used by the processor to gate printer status (AIN0-8) into the processor.

6.3

Primary Power

The 160 CPS Printer, as supplied from Datapoint, is configured to operate at 120 VAC, $\pm 10\%$. However, it is field configurable at installation for operation with input voltages of 100, 120, 220, and 240 VAC $\pm 10\%$ at a frequency between 47.5 and 52.5 Hz, and 57 to 63 Hz. Power ground is connected to the printer chassis ground but is isolated from printer logic ground through a 1 K-ohm resistor. Worst case power consumption is 200 watts.

Current: 1.50 A at 120 VAC

7.0

OPTIONS

7.1

Line Spacing

The operator can select line spacing of either 6 LPI or 8 LPI. This option is installed in every printer.

7.2

Form Length Select

Form length is operator selectable from 1 to 99 lines by using the Form Length Select switches. This option is installed in every printer.

7.3

Input Power

The printer is field configurable to several different primary input power sources (see Section 6.3).

7.4

Address

The normal address of the printer is 0303, but it may be strapped at installation to any legal peripheral address.

7.5

Baud Rate

The printer can be configured at installation to operate at 9600, 4800, 2400, 1200, 600, 300, 150 baud, or to operate from an external 8x or 16x clock. Receive and transmit baud rates may be independently selected. The printer is shipped to operate at 9600 baud.

7.6

Parity

An option strap on the parallel interface assembly can be used to configure the printer at installation to accept data in either the 6600/5500 or 2200/1100 I/O modes. The printer is shipped in the nonparity mode.

7.7

Optional PROM

An Optional PROM which contains a custom character set is available for international customers. (See subsection 3.2.2 for details.)

7.8

Mechanical VFU

If the factory-installed optional mechanical VFU is in use, form length control can also be set by the operator by adding or deleting links and flags in the VFU chain. Form length can be set from 1/4 inch to 24 inches.

7.9

Compressed/Expanded Print Option

The Compressed/Expanded Print Option (see subsection 3.2.3) can be ordered with the printer as it is shipped or as a field upgrade kit.

8.0

SHIPPING LIST

A generalized list of items shipped with the 160 CPS Printer follows:

Quantity	Item
1	<i>Input/Output Cable (parallel only)</i>
1	<i>Universal Cable Kit (serial only)</i>
1	<i>Ribbon Cartridge</i>
1	<i>160 CPS Matrix Printer Product Specification (Document Number 60793)</i>
1	<i>Operating the Datapoint 9621/9622 Series 160 CPS Matrix Printer (Document Number 60830)</i>
1	<i>One-inch (2.45-cm) stack of full width, 15-inch (38.1-cm) paper</i>

Note: The above shipping list is for information purposes only and may be amended from time to time by Datapoint Corporation.



Warning: This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instruction manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.